

### **REMARKS**

Reconsideration of this application is requested.

Upon entry of the attached amendment, claims 1-11 will be pending in this application for the Examiner's review and consideration. Claims 1-5 have been amended in accordance with the Examiner's suggestion to change the term "oxinitride" to "oxynitride." Claim 1 has also been amended in accordance with the Examiner's suggestion to add the language "so that the element composition is an oxynitride" after "1.7" and before the comma. Claims 7 and 8 have been amended to add the word "one" after the word "least."

### **Objections to Specification**

Applicants respectfully note the submission of a substitute specification which addresses the objections cited by the Examiner on page 2 of the Office Action. More particularly, the substitute specification does not contain photocopy marks throughout the text, and the Brief Description of the Drawings section has been moved so that it starts at page 4, line 15. Additionally, the term "oxinitride" has been changed to "oxynitride" throughout the specification.

Applicants note that a clean version of the substitute specification is submitted as well as a separate, marked up version showing the changes in the specification relative to the previous version. The substitute specification contains no new matter.

### **Claim Objections**

Claims 1-5 were objected to because of informalities concerning use of the term "oxinitride." In accordance with the Examiner's suggestion, Applicants have amended claims 1-5 to change the term "oxinitride" to "oxynitride." Applicants note that this change should obviate the rejection, and respectfully request withdrawal of the objection.

### **Claim Rejections Under 35 U.S.C. § 112, Second Paragraph**

Claims 1-5, 7 and 8 were rejected under 35 U.S.C. § 112, second paragraph for the reasons discussed on pages 2 and 3 of the Office Action. With regard to the rejection of claims 1-5, Applicants have amended claim 1 in accordance with the

Examiner's suggestion to add the language "so that the element composition is an oxynitride" after "1.7" and before the comma. With regard to the rejection of claims 7 and 8, Applicants have amended these claims in accordance with the Examiner's suggestion to add the word "one" after the word "least." Applicants note that these amendments should obviate the rejections, and respectfully request withdrawal of the rejections.

**Claim Rejections Under 35 U.S.C. § 102/103§**

Claims 6-10 were rejected under 35 U.S.C. § 102(b) as anticipated by, or, in the alternative, under 35 U.S.C. § 103(a) as obvious over O'Leary *et al.*, "Electron transport in wurtzite indium nitride," J. Appl. Phys., 83(2), pages 826-829, January 15, 1998 ("O'Leary") for the reasons discussed on pages 3 and 4 of the Office Action. Applicants respectfully request reconsideration for the reasons that follow.

The present invention relates to a nitride or oxynitride thermoelectric material which has a low electrical resistivity (of nitride) and a high absolute value of a Seebeck coefficient such that it can be employed as a thermoelectric element in thermoelectric conversion. The nitride or oxynitride thermoelectric material can have an amorphous structure. The thermoelectric materials of the present invention comprise elements which have low toxicity, are excellent in heat and chemical resistance, and have a high thermoelectric transforming efficiency.

O'Leary teaches the velocity-field characteristics of wurtzite indium nitride. O'Leary also reports the material physical values and sonic velocities with regard to the effective mass and stoichiometric composition of InN or GaN. The reference, moreover, provides important basic data concerning the electron or phonon transport characteristics. O'Leary does not, however, teach the Seebeck coefficient (50  $\mu\text{V/K}$ ) and electrical resistivity ( $10^{-3} \Omega\text{cm}$  or less) recited in claims 6-10. One of ordinary skill in the art cannot predict the Seebeck coefficient at room temperature with any accuracy from only these data. Nor does O'Leary teach or suggest compositions within the restricted range of components recited in formula (B) of claim 6.

Applicants respectfully submit that O'Leary does not teach or suggest each and every limitation of independent claim 6 of the present invention and thus does not teach or suggest each and every limitation of claims 7-10, which depend from claim 6. More

particularly, O'Leary does not teach or suggest a nitride thermoelectric material within the restricted range of components recited in formula (B) of claim 6. Additionally, O'Leary does not teach or suggest a nitride material with an absolute value of a Seebeck coefficient of 50  $\mu\text{V/K}$  at a temperature of 100 °C or more and an electrical resistivity of  $10^{-3} \Omega\text{cm}$  or less. For at least these reasons, O'Leary does not anticipate or render obvious claims 6-10 of the present invention.

Furthermore, there is no motivation or suggestion in O'Leary to modify the reference to produce the nitride thermoelectric materials of the present invention. O'Leary, while reporting various material values and transport characteristics with regard to the effective mass of InN or GaN, is absolutely silent regarding values of a Seebeck coefficient. One of ordinary skill in the art would not be able to predict the value of the Seebeck coefficient from the experimental results data taught or suggested by O'Leary. Accordingly, there is no motivation, either in O'Leary or in knowledge available to one of ordinary skill in the art, to modify the reference to produce the features of the claimed invention. For this additional reason, Applicants respectfully submit that one cannot establish a *prima facie* case of obviousness with respect to the O'Leary reference.

Claims 6-9 and 11 were rejected under 35 U.S.C. § 102(b) as anticipated by, or, in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 4,365,107 to Yamauchi ("Yamauchi") for the reasons discussed on page 4 of the Office Action. Applicants respectfully request reconsideration for the reasons that follow.

Yamauchi is directed to an amorphous film solar cell of p-i-n heterojunction type produced through the combination of group III-V compound amorphous semiconductor films with a layer of fluorinated or hydrogenated amorphous silicon semiconductor material. Yamauchi is not at all related to thermoelectric materials used in thermoelectric conversion.

Applicants respectfully submit that Yamauchi does not disclose or suggest each and every element of claim 6 and thus does not teach or suggest each and every limitation of claims 7-9 and 11, which depend from claim 6. More specifically, Yamauchi does not teach or suggest a nitride thermoelectric material within the restricted range of components recited in formula (B) of claim 6. Nor does Yamauchi teach or suggest a nitride material with an absolute value of a Seebeck coefficient of 50  $\mu\text{V/K}$  at a temperature of 100 °C or more and an electrical resistivity of  $10^{-3} \Omega\text{cm}$  or less. For at

least these reasons, Yamauchi does not anticipate or render obvious claims 6-9 and 11 of the present invention.

Furthermore, there is no motivation or suggestion in Yamauchi to modify the reference to produce the nitride thermoelectric materials of the present invention. Yamauchi is in no way related to thermoelectric materials used in thermoelectric conversion and does not disclose values of a Seebeck coefficient. One of ordinary skill in the art would not be able to predict the value of the Seebeck coefficient from the disclosure in the table in Yamauchi. Accordingly, there is no motivation, either in Yamauchi or in knowledge available to one of ordinary skill in the art, to modify the reference to produce the features of the claimed invention. Nor would there be any reasonable expectation of success in applying the solar cell material of Yamauchi to produce the claimed invention. For these additional reasons, Applicants respectfully submit that one cannot establish a *prima facie* case of obviousness with respect to the Yamauchi reference.

Claims 1-5 were rejected under 35 U.S.C. § 102(b) as anticipated by, or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Steffes *et al.*, "New  $\text{IN}_x\text{O}_y\text{N}_z$  films for the Application of  $\text{NO}_2$  sensors, Sensors and Actuators B, vol. 77 (2001), pages 352-358 for the reasons discussed on pages 4 and 5 of the Office Action. Applicants respectfully request reconsideration for the reasons that follow.

Steffes is directed to research on indium oxynitride films used in gas-sensing applications. Steffes discloses various data related to physical characteristics and gas measurements for indium oxynitride films. Steffes is absolutely silent regarding the measurement of electrical resistivity and Seebeck coefficient.

Applicants respectfully submit that Steffes does not disclose or suggest each and every element of claim 1 and thus does disclose each and every element of claims 2-5 which depend from claim 1. More particularly, Steffes does not disclose specific Seebeck coefficients or thermoelectric materials within the restricted range of components recited in formula (B) of claim 1. Moreover, Steffes does not disclose or suggest enough technical information which could be used by one of ordinary skill in the art to predict the Seebeck coefficient recited in claim 1. For at least these reasons, Steffes does not anticipate or render obvious claims 1-5 of the present invention.

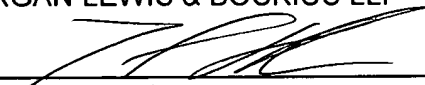
Additionally, there is no motivation or suggestion in Steffes to modify the reference to produce the nitride thermoelectric materials of the present invention. Steffes is related to indium oxynitride films used in gas-sensing applications, not thermoelectric materials used in thermoelectric conversion, and Steffes does not disclose values of a Seebeck coefficient. One of ordinary skill in the art would not be able to predict the value of the Seebeck coefficient from the disclosure in Steffes. Accordingly, there is no motivation either in Steffes to modify the reference to produce the features of the claimed invention. Nor would there be any reasonable expectation of success in applying the data disclosed or suggested in Steffes to produce the claimed invention. For these additional reasons, Applicants respectfully submit that one cannot establish a *prima facie* case of obviousness with respect to the Steffes reference.

Reconsideration with allowance is requested.

Respectfully submitted,

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